

SPACE: Enabling Army Transformation

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INCREASING LETHALITY, mobility, and sustainability are key to Army Transformation, but increasing lethality while exchanging heavy divisions for mobility raises questions. The answers are increasingly found in space. Space assets and the capabilities that they bring to the warfighter will reduce the logistics footprint in theater, allow U.S. forces to outmaneuver the enemy, and inflict devastating firepower on opponents before they can target U.S. or friendly forces.

Fighting in the Transformation Environment

The United States has obvious capability and power advantages over potential adversaries. To offset those advantages, adversaries may attempt to exploit perceived U.S. weaknesses by using asymmetric operational strategies, tactics, and techniques using urban terrain and information operations. Operational boundaries along traditional fronts may be a thing of the past. The forward line of own troops (FLOT) is more likely to be a circle than a line. Where is the "rear"? It could just as easily be in an adjacent country as in theater. Potential enemies will attempt to keep U.S. forces disjointed, complicate resupply, degrade communications, and disrupt coordination.

Nearly 45 percent of the world's population resides in urban settings. The U.S. Marine Corps Intelligence Activity anticipates urban populations will increase by 60 percent within the next 10 years.¹ Adversaries may use urban areas and complex terrain to negate technological advantages the United States holds in intelligence, maneuver, and precision fires to create strongholds, find sanctuary, or prolong conflict. Such areas degrade weapon system standoff, target acquisition, situational awareness, and accuracy. Our adversaries realize that complex terrain is troop and supply intensive and further complicates applying firepower in an effort to avoid collateral damage and non-combatant injuries. Urban terrain reduces combat actions to the basic level—the dismounted infantry assault—thus leveling the playing field significantly.

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Robust command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) capabilities and high mobility will enable the objective force to develop the situation out of contact, to maneuver rapidly to positions of advantage, and to initiate contact at the commander's choice of time and place. Reconnaissance, surveillance, and target acquisition (RSTA) organizations are key to developing the situational understanding required in this complex environment.

Army Transformation forces must be equipped with appropriate Army Battle Command System (ABCS) or ABCS-like systems down to platform level if they are to support robust command and control (C2). The C4ISR networks and computers must be able to receive and disseminate large volumes of voice and video data rapidly to adjacent, higher, joint, and allied units in complex terrain environments. Long-range, nonlinear-of-sight (NLOS) tactical systems will become the principal means of communication.

Rules of engagement (ROE) define the circumstances and limitations under which U.S. forces will initiate or continue combat engagement. As demonstrated in the Balkans, restrictive ROE can constrain or delay U.S. combat power. Adversaries may attempt to exploit indecisiveness or restrict U.S. combat capabilities. The ability to beam U.S. battles in near real time to American living rooms continues to increase. Images, both still and video, might influence the development of ROE. Adversaries may exploit the media or conduct information operations to attack U.S. national will or upset coalitions. Saddam Hussein used this tactic following the U.S. and British air strikes against Baghdad.

1st Infantry Division vehicles staged at the Greek port of Thessalonika in support of Operation Joint Guardian, July 1999.

US Army



The easiest tactic to prevent massing U.S. combat power is to deny entry into a theater of operations. Adversaries will attack APODs and SPODs using coordinated operations conducted by police, paramilitary, special purpose, guerrilla, mercenary, terrorist, and conventional forces. Using long-range surface-to-surface missiles (SSMs), cruise missiles, and other WME will also give U.S. forces a nonlinear, simultaneous battlespace.

Potential adversaries study U.S. capabilities in detail and may seek to degrade them by using lethal and nonlethal means to strike C4ISR capabilities and platforms. Proliferating commercial technology with military applications and the associated vulnerabilities of attempting to achieve information superiority through space technology virtually ensure future combat operations will emphasize information warfare. Secure access to space capabilities is so important that the U.S. Navy is ready to spend more than \$100 million upgrading its ability to track space objects or debris from its ground stations. Improvements that allow the United States to track potato-sized objects will not only help prevent debris collisions, but it will also help detect parasitic satellite attacks on U.S. satellites.

The interim brigade combat team (IBCT) has no organic space-qualified soldiers assigned to it. The first appearance of space operations personnel is in the interim division (IDIV) with a cell of four officers and two noncommissioned officers (NCOs). In the interim, Army space support teams could augment the IBCT, but is that enough? Could the reconnaissance, intelligence, surveillance, and target acquisition (RISTA) squadrons also use this expertise to cover the huge areas to which they will be assigned now that brigades are responsible for what

divisions used to cover? Will we pull space operations officers from staffs throughout the Army to use as augmentees? Will that upset the tactical operations center's staff procedures? How will they get there? What equipment will they bring? Where will their equipment go?

The enemy's interdiction of air and sea lines of communications was once believed to be the major threat to U.S. power projection. However, a recent intelligence assessment outlines a shift in focus to attacks against aerial and seaports of debarkation (APODs and SPODs) as a more advantageous tactic.² Future adversaries are expected to invest in capabilities for special operations forces and weapons of mass effects (WME) for just such operations.

In reaction to the worldwide explosion in information technology, there is an increasing migration of capabilities to space. The relative advantage the United States enjoys in satellite reconnaissance, communications, and navigation will erode as the number of countries capable of using space-based programs for military purposes increases. In addition, commercializing space makes these capabilities available to all. Apart from the United States losing its asymmetrical advantage in this area, access to commercial systems will allow even low-tech forces to employ information-age capabilities.

The southern tip of San Francisco's financial district, viewed from a commercial satellite. Military satellites obtain considerably more detailed imagery in low-Earth orbit.

spaceimaging.com

Knowing the size and scope of the urban battlespace improves troop and asset planning. Are the buildings one story or five? Do they have basements? Is undetected movement possible? . . . Reducing uncertainty for the ground commander saves troops, assets, and time while enabling accurate planning for lethal and nonlethal precision engagement.

Key Operational Concepts

Intelligence collection systems, satellite communications, situational awareness tools, global positioning systems (GPS), and space-based weather satellites are real technologies that the United States dominates. That dominance, however, slips slightly every day. The U.S. military must seek leap-ahead technologies and applications to retain its dominance and properly equip the Objective Force.

Space is a transparent force multiplier and enabler whose use is largely unnoticed. Casual observers are unaware of what capabilities really affect them from space. Whether in the open deserts of Iraq and Saudi Arabia or the complex terrain of Sarajevo, satellites increasingly link soldiers and units to headquarters, bases, and families back home. Satellite communications, GPS, and accurate weather and terrain data are the norm for today's force.

Vital to maintaining the technological advantage is controlling space. Superior technology alone will not carry the United States very far if the assets it depends on are at risk. Jamming, spoofing, or destroying our space-based assets are real threats. As U.S. forces depend more on GPS, situational awareness, and overhead imagery, space control becomes even more significant to soldiers on the ground. The last thing the United States can afford in terms of

dollars and lives is huge investments in space-based technologies and programs only to fall victim to a "space Pearl Harbor." Examining key operational concepts for Army Transformation with a "space eye" illuminates some areas ripe for contributions to the Objective Force.

Strategic Responsiveness and Maneuver

The U.S. military is not deployed in all areas of the world where future regional conflicts might be fought. Therefore, the United States must be able to project and sustain power over time and distance. The easiest tactic to prevent massing U.S. combat power is to deny entry into a theater of operations. Adversaries will attack APODs and SPODs using coordinated operations conducted by police, paramilitary, special purpose, guerrilla, mercenary, terrorist, and conventional forces. Using long-range surface-to-surface missiles (SSMs), cruise missiles, and other WME will also give U.S. forces a non-linear, simultaneous battlespace.

Such threats may deny the United States access to U.S.-friendly countries or at least delay U.S. entry through protracted negotiation, hostage-taking, or appearing to modify policy to conform to U.S. demands. Adversaries already are adept at manipulating international media to criticize U.S. intervention,

decrease international resolve, and affect deploying U.S. forces' ROE and force mix.

During the deployment phase of an operation, U.S. forces at APODs and SPODs are more vulnerable to attack than at any other time. A well-placed SSM or cruise missile at the right time could effectively shut down an airfield, isolate or denigrate U.S.

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forces already on the ground, or significantly reduce American political resolve at home. How can the United States protect its forces from such attack?

One defense is to develop a light, deployable theater missile defense (TMD) tactical operations center (TOC) to alert and defend deploying forces from attack. This TMD TOC cannot be a multiple-sortie, Taj Mahal package with 24 high-mobility, multipurpose wheeled vehicles (HMMWVs). It must be a small package suitable for shipment on one or two transport aircraft and able to provide early warning defense for deploying forces. It can deploy into the APOD behind the assault force to protect inbound forces as they debark and assemble. Manned by the space support element (SSE), the TMD TOC gives the commander immediate access to C2 nodes for global communications. The TMD TOC can also be the focal point for coordinating APOD/SPOD operations. Surveillance assets can feed in data and imagery directly.

This front-loaded, minimal-capability, light TOC could also link inbound aircraft with commanders needing en route mission planning information during deployment. The assault TMD TOC can be a two-way conduit to push forward or reachback for information, operations, and synchronization with joint forces.

In conjunction with the assault TMD TOC, it is important to develop a smaller, active TMD capability for APOD or SPOD assurance that provides an offensive response to missile threats. This force protector might have four to six HMMWVs mounted with advanced medium-range air-to-air missiles (AMRAAMs). AMRAAMs have a shorter

range than a Patriot or theater high-altitude area defense, but they provide a smaller deployment footprint. Emphasis would initially be on securing the APOD or SPOD, not the entire theater.

Simultaneous Engagement and Distributed Operations

Space contributions in imagery, communications, and situational understanding will help the Transformation force commander focus on the most important aspects of the enemy's operations. Advances in precision targeting and increased ranges will achieve mass fires and effects without massing weapon systems. GPS is integrated into most of our long-range munitions, greatly improving the probability of first-round kills. GPS is, however, vulnerable to jamming. Technologies to alleviate GPS degradation include space-based and terrestrial solutions.

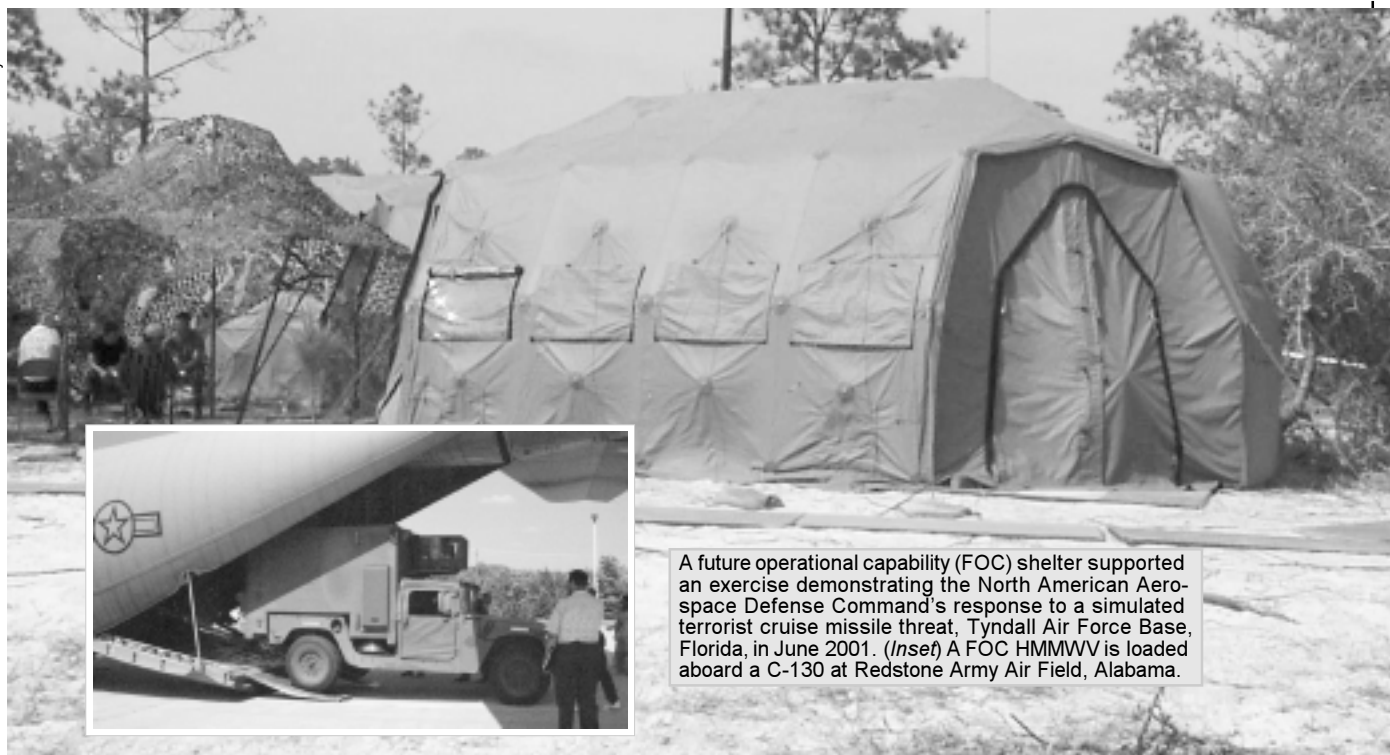
Advanced precision will allow higher payoff targeting when executing operations. Multiple targets simultaneously attacked by deployed forces will deplete scarce, critical enemy resources in the battlespace. Precision targeting helps the commander keep ground forces out of unnecessary contact.

Bomb damage assessment (BDA) has always been a subjective, inexact science. BDA estimates from Operation Desert Storm, the Balkans, and Iraq show that BDA accuracy seems to degrade over time. BDA is time-consuming and drains scarce human and mechanical assets and platforms. Space-based assets can play a major role in getting timely and accurate BDA to decisionmakers while limiting the degradation of human and unmanned aerial vehicle assets.

Complex terrain poses problems for movement, cover, concealment, and target detection. Clearing small pieces of this terrain can be time-consuming. Adding to the confusion in the complex urban battlespace is the presence of noncombatants. Besides the local populace, there may be nongovernment organizations or private volunteer organizations. A smart enemy will use the organizations' presence to impede U.S. forces.

Knowing the size and scope of the urban battlespace improves troop and asset planning. Are the buildings one story or five? Do they have basements? Is undetected movement possible? Can we develop a space-based technology that provides a subterranean picture? Reducing uncertainty for the ground commander saves troops, assets, and time while enabling accurate planning for lethal and non-lethal precision engagement.

Maps are only as accurate as their latest update, but three-dimensional mapping and fly-throughs provide realistic rehearsals for operations. Com-



A future operational capability (FOC) shelter supported an exercise demonstrating the North American Aerospace Defense Command's response to a simulated terrorist cruise missile threat, Tyndall Air Force Base, Florida, in June 2001. (Inset) A FOC HMMWV is loaded aboard a C-130 at Redstone Army Air Field, Alabama.

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manders can use fly-throughs to conduct planning and rehearsals in or out of theater to increase force protection and lethality and to allow them to focus on the real fight.

Never before has so much information been passed in so many ways. This is true for both military communications and traditional commercial systems such as cell phones. Electronic intelligence collection from nontraditional, unclassified messaging sources—cell phones, satellite communications, wireless local area networks—gets the most from limited communications intelligence assets. Locating emanating sites, particularly if they are of unusual size or location, can reveal significant intelligence about enemy capabilities and intentions.

Effective Response to a Multidimensional Adversary

The Objective Force must also coordinate with and gain cooperation from other agencies. Subject matter experts from agencies outside the Department of Defense (DOD) may bring nonlethal expertise to the table. The Objective Force will be designed and trained to meet the multidimensional challenge of simultaneous conventional and unconventional force operations.

Information operations, in its full breadth, brings a new suite of coordinated attack weapons to the commander's arsenal. Space operations officers and Army space support teams coordinate lethal and

nonlethal effects of information attack weapons for the commander. Now the commander can coordinate all effects whether they originate in fire support, in civil affairs, or on a console in the Pentagon.

The Army Battle Command System (ABCS) does not address synchronizing full-spectrum information operations, but lethal and nonlethal fires must be synchronized. Only recently have we begun to think of battle damage being inflicted via methods other than just steel on target. Even more foreign is the idea that steel, combined with electrons at the right place and time, can have a more devastating effect than just more steel.

When required, the commander can inflict quick, violent, simultaneous attacks at the right time and place to exploit and defeat enemy centers of gravity. How we integrate and formulate the plans to make such attacks can rely heavily on space for success.

The ability to pass information, imagery, and data directly to soldiers in contact can bring the battlespace simultaneously to soldiers and commanders. Linking space to individual soldiers to provide near real time information by NLOS expedites decisive planning. Only space-based assets can provide this conduit.

As the battlespace becomes less and less contiguous, the need for NLOS communications to pass voice, data, and imagery from point to point increases almost exponentially. Distance, weather,

terrain, and bandwidth significantly hamper line-of-sight (LOS) communications. Blue force tracking technology relies heavily on LOS. Equally important is a reachback capability that allows deployed

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forces to communicate with their higher headquarters. Only a robust space capability that pushes information to the commander on the ground can support reachback.

The concept for an effects coordination cell is to manage and coordinate all lethal and nonlethal effects for the force. This will require using previously abstract weapons in the battlespace arsenal. Perhaps we "prep the battlespace" by destroying indigenous broadcast towers using a hardware-crippling virus on the primary government local area network as we launch heliborne psychological operations or civil affairs missions to influence the local population. Only by precise, integrated, coordinated planning will the commander be able to most efficiently employ all assets. This can only be accomplished with uninterrupted space-based links from sensor to platform.

Continuous Operations and Overwhelming Operations Tempo

The Objective Force will bring formidable firepower at a rate and speed that will overpower any adversary. The key to success is to overwhelm the enemy's ability to respond. One way to achieve this is to conduct simultaneous, noncontiguous operations. Continuous planning cycles requiring varied, complex, and detailed information are necessary. The next generation of the En-route Mission Planning and Rehearsal System could include receiving orders and conducting plans with one higher headquarters and then, due to change of mission, finish coordinating and executing that plan with a different headquarters. Can we do this inside the theater? What if we used C-130s like we use Black Hawks? Can we put a company on an airplane and move it to a different operation within the theater with most of the planning and rehearsal being conducted on the aircraft? Can we push that much information that

quickly? Only space-based assets have the potential capacity to allow the commander to simultaneously coordinate and integrate NLOS communications, simulation tools, and situational awareness while in flight from potentially nonparallel over-the-horizon flight paths.

To overcome the enemy's ability to respond, the commander must be able to manage information. The best intelligence or information is useless if the person who needs it does not receive it. Conversely, information overload is equally crippling. We can manage information flow from the source to the commander and staff by filtering incoming information so the right person is the ultimate receiver.

The Objective Force division has a modular SSE of four officers and two NCOs. Half of the SSE will reside in the G3 plans cell of the main command post (CP); the other half is assigned to the tactical CP's G3 maneuver cell. Depending on the mission, any portion of the SSE could be task organized to a battalion combat team; thus, the SSE must be modular to plug into the CP architecture.

Situational Understanding and Information Superiority

Advanced capabilities in the areas of situational understanding and information superiority will significantly reduce the decision cycle, thereby overtaxing the enemy's ability to respond to U.S. actions. ISR assets organic to the Objective Force teamed with joint or theater assets will expand situational awareness of Army battlespace capabilities. RISTA forces and unmanned surveillance assets will provide a more comprehensive battlespace picture and allow commanders to effectively deploy and commit forces and enhance survivability.

Reliance on these assets and the intelligence they produce can lead to vulnerability for all users of space-based assets and information. How easy is it for an operator to detect an electronic attack when his display appears fine? Is the information he sees real? Has it been electronically altered to lead the commander to make a wrong decision? This greatly concerns the U.S. Space Command.³

Jamming technology is prevalent and cheap. Technological advances in miniaturization are leading to the development of micro- and nanosatellites. These satellites can shadow or intercept friendly space assets and be programmed to disrupt or destroy their targets on command. As these get smaller, detection will become increasingly difficult. Still more dangerous is the threat of an electromagnetic pulse generated from space. The effects of a small-yield blast could affect every satellite in low orbit almost indefinitely. Once disabled, there is no quick fix to reestablish a satellite network.

In a dangerous game of one-upsmanship, computer hackers challenge each other to sophisticated attacks against U.S. computer networks. DOD systems alone receive more than 30,000 detected probes a year. In the past 12 months, 85 percent of U.S. government agencies and Fortune 500 companies have reported security breaches resulting in \$400 million in financial losses.⁴ These breaches are not necessarily hostile. Often, they result from U.S. citizens pushing their personal and professional limits to see just how far they can go and what they can get away with. To them, it is a game; to the banking industry, the Federal Communications Commission, the Federal Aviation Administration, and DOD, it is not.

Denying the enemy's use of GPS for targeting, tracking, and situational awareness is key to the survival of U.S. forces deployed in theater. By denying GPS access to the enemy at key points in an operation, the friendly commander could disrupt enemy C2 and other operations and gain the advantage.

GPS jammers are relatively low-cost, low-tech tools. Confusion in the battlespace can influence the battle's outcome. We must ensure that technological advances reduce friendly battlespace confusion. Urban and complex terrain pose special situational awareness problems. GPS does not perform well there. Technologies used in conjunction with 911 cellular services could provide a solution to this problem. Soon, all newly manufactured cell phones must enable police to locate cellular 911 callers. Lucent Technology is preparing to deliver a system that can track the locations of all cell phone users within a few feet.

Rapid, violent, integrated, simultaneous military

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operations conducted speedily in locations that will overwhelm the enemy's decision cycle and response time will defeat the enemy with a minimal loss of American lives. The battalion combat team's centerpiece is dismounted infantry assault. Vital to the success of the assault is integrating the land warrior into the battlespace. Land warriors should be privy to information and technology never before imagined. Integrating and protecting that flow will require space-based assets and will allow the United States to overwhelm the enemy's ability to counter the Objective Force. Providing intelligence and updates to soldiers on the move will be critical to the land warrior's success.

The U.S. Army Space and Missile Defense Command is uniquely positioned to be the linchpin for Army Transformation. Many of the innovations that the Objective Force requires rely on space-enabled capabilities and technologies. The Space and Missile Defense Battle Lab, Force Development and Integration Center, Army Space Program Office, Army Space Command, and Missile Defense Command are poised and ready to bring space and space integration to the battlespace and the Objective Force. **MR**

NOTES

1. U.S. Marine Corps Intelligence Activity, *Marine Corps Midrange Threat Estimate, 1997-2007* (Quantico, VA: U.S. Government Printing Office [GPO], 1997).
2. Department of the Army, Deputy Chief of Staff for Intelligence, *Threat Panel White Paper* (Washington, DC: GPO, 1999).

3. Statement by General Eberhart, Commander, U.S. Space Command, *The Washington Times*, 29 March 2001.

4. Condoleezza Rice, "National Security Adviser says Cyber Security Will be U.S. Priority," *Defense News*, 22 March 2001.

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